Recovery Plan Action Status

Plan Name: Persistent Trillium
Plan Status: Final
Plan Date: 27-Mar-84
Lead Agency: USFWS
Lead Office: Georgia Ecological Services Field Office
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Species	Action Priority #	Action #	Action Description	Action Status	Est. Initiation Date	Est. Completion Date	Responsible Parties	Work Type	Labor Type	Action Comments

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Persistent trillium (Trillium persistens)	2	1.1	Search for additional populations	Complete	Prior to FY 1995	FY 2010	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research: Population Surveys	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	*1. Other agencies' responsibilities would be of a cooperative nature on projects funded under a FWS contract or grant program. In some cases contracts may be let to universities or private enterprises. E*2. NOTE: ALL COST ESTIMATES FOR FWS FUND ONLY. Initiation date based on publication of Recovery Plan. No additional range extensions since publication of RP, but more aggregations of plants discovered within global range, especially in Tallulah Gorge. Panther Creek area surveyed by Ben Dickerson and Pete Pattavina in 2010, small expansion of occupied area, but species limited to two ravines,as previously noted in recovery plan. Studies performed in SC subsequent to publication of RP, but no additional populations found other than existing Battle Creek population (Robin Mackey, USFS). Big Shoal Creek surveyed in early 2010 by B. Dickerson, P. Pattavina, James Sullivan, and Tom Patrick, based on recommendation of J. Sullivan--no evidence of T. persistens found.

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										No populations have been discovered north of Tallulah Lake, and this area likely delimits the upstream extent of the global range.

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Persistent trillium (Trillium persistens)	2	1.2	Determine population size and age-size class distribution	Partially Complete	Prior to FY 1995	FY 2031	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Initiation date based on first survey season of demographic studies performed by Slay (1989). Slay performed 5-year study using permanent plots. Demographic composure and abundance remarkably stable, but study probably not long enough to elucidate trends in population dynamics. Likely need individual plant marking, permanent plots, and at least ten years. New abundance studies needed over entire global range. Currently, abundance estimates published in recovery plan and performed though 1985 provide a single observation for each population, and observations spread over numerous field seasons. Need large-scale efforts to document abundance globally, all sites need visitation in same season and then need re-visitation for at least 4 additional seasons--or an adequate subsampling should occur appropriate number of permanent plots, in conjunction with demographic study. Ben Dickerson and Pete Pattavina performed thorough census of Panther Creek population in

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										2010--total abundance (all size classes) at 3822 stems, an increase over the 2113 total stems reported in recovery plan.
Persistent trillium (Trillium persistens)	2	1.3	Determine population protection priorities	Partially Complete	Prior to FY 1995	FY 2016	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert	Initiation date based on publication date of Recovery Plan. Without genetic analyses, population priorities likely remain unchanged, as published in Recovery Plan. Genetic analyses could change priorities if there is wide variability in inter and/or intrapopulation genetic composure.

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Persistent trillium (Trillium persistens)	1	1.4	Evaluate protection alternatives	Partially Complete	Prior to FY 1995	FY 2011	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Acquisition, Acquisition: Easement, Acquisition: Fee Title, Acquisition: General, Acquisition: Lease, Acquisition: Management Agreement	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance	Update needed to assess boundaries of GADNR owned lands, related to abundance estimates and occupied habitat acreage. Panther Creek population wholly-owned by US Forest Service part of a land swap with Georgia Power Company. Long-term land lease terminated, approx. in 2010, with fee-simple transfer of some lands from Georgia Power to GADNR (need to find out actual transfer boundaries). Jim Candler (2010) state that GA Power needed to keep lands that are contained in FERC document, not sure how those FERC lands relate to trillium abundance. At least one privately-owned site (private, roadside park, old Stuckeys) now in state ownership. Land owner boundaries for all land tracts need to be related to population abundance estimates. Initiation date based on publication of recovery plan.

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Persistent trillium (Trillium persistens)	1	1.5	Implement the most appropriate protection measures	Ongoing Not Current	Prior to FY 1995	FY 2031	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Work type not yet selected	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Cost: unknown. Initiation date based on publication of Recovery Plan. Generic long-term protection strategy currently based on preservation of forest canopy. Without conclusive studies on species habitat needs and long-term demographic trends, in-depth protection strategies can not be implemented. At very least, USFWS should work with partners to implement a monitoring strategy to continually assess impending threats to forest health, including invasive species infestations (wooly adelgid, kudzu, etc.).

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Persistent trillium (Trillium persistens)	2	2.1	Select study sites	Partially Complete	Prior to FY 1995		U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Initiation date based on first field season of Slay demographic study. Slay(1989) selected study sites based on Recovery Plan guidance. A reassessment of site selection guidance should be employed and temporal span of any demographic study should probably be increased to at least 10-15 years. Slay study found very stable demographic composure using permanent plots. Individual plants should probably be marked and longer term study possibly needed since T. persistens is an incredibly long-lived species.
Persistent trillium (Trillium persistens)	2	2.2	Conduct habitat analysis within each study site	Partially Complete	Prior to FY 1995		U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Initiation date based on beginning of field season of Gaddy (1985).Gaddy performed some small-scale studies on site suitability and habitat composure. Sites highly variable and Gaddy found inconclusive trends when comparing populations to physical and chemical properties of the soil. Additional studies should focus on forest structure, in concert with edaphic, and abundace/demographic observations.

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Persistent trillium (Trillium persistens)	2	2.3	Conduct long-term demographic studies	Not Started	Prior to FY 1995	FY 2032	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research: General	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Initiation date based on beginning of Slay's field season from 1983-1988. Longer term studies likely needed to determine population dynamics of a long-lived, slowly reproducing species such as T. persistens. Study may need to span 10-15 years with marking of individual plants and permanent study plots.
Persistent trillium (Trillium persistens)	3	2.4	Determine effects of past disturbances	Not Started			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	May be difficult study to structure and assumptions could perhaps be made through long-term demographics study for different habitat types and possibly related to past forestry actions.
Persistent trillium (Trillium persistens)	2	2.5.1	Determine annual regimes of relative humidity in exposed and sheltered habitats	Partially Complete	Prior to FY 1995		U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Cost: unknown. Initiation date based on Gaddy study field season. Gaddy performed studies in 1984, but could not statistically link variables in soil characteristics with population measures.

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Persistent trillium (Trillium persistens)	2	2.5.2	Determine annual regimes of soil moisture in exposed and sheltered habitats	Partially Complete	Prior to FY 1995		U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Cost: unknown. Initiation date based on beginning of 1984 field season of Gaddy (1985). Gaddy performed some small-scale studies on site suitability and habitat composure. Sites highly variable and Gaddy found inconclusive trends when comparing populations to physical and chemical properties of the soil. Additional studies should focus on forest structure, in concert with edaphic, and abundace/demographic observations.
Persistent trillium (Trillium persistens)	2	2.5.3	Determine the relationship between light intensity, establishment, reproduction, and seed germination.	Not Started			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Cost: unknown. At least 4 years needed, since species produces radicle first year and leaves the second. Flowering can be accomplished in 4-6 years, in cultivation.

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Persistent trillium (Trillium persistens)	2	2.5.4	Determine the vectors of seed dispersal and assess their effectiveness under difficult ecological conditions.	Not Started			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Cost: unknown. Fine-scale genetic analyses could be cost-effective way to determine seed dispersal using nearest neighbor analysis with micro-satellite DNA work, could be combined with more general inter and intrapopulation genetics investigations. Species not known to be clonal.
Persistent trillium (Trillium persistens)	2	2.5.5	Determine major pollinators and assess their effectiveness under different ecological and spatial conditions	Not Started			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Cost: unknown.
Persistent trillium (Trillium persistens)	1	2.6	Develop appropriate habitat management techniques as determined through Tasks 2.1-2.5	Not Started		FY 2031	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Management, Management: General, Management: Habitat Maintenance and Manipulation, Management: Land Use, Management: Predator and Competitor Control, Research	Contract, Graduate Student, Internal Field Assistance, Internal Technical Assistance, Species Expert	Cost: unknown. Current habitat management or long-term habitat targets non-existent. Need more research on recruitment and abundance for different habitat types to generate habitat management techniques. Need to re-initiate long-term demographic studies to refine goals.

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Persistent trillium (Trillium persistens)	1	2.7	Implement appropriate habitat management techniques	Ongoing Not Current			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Management, Management: Habitat Maintenance and Manipulation, Management: Land Use, Management: Planning, Management: Predator and Competitor Control	Labor type not yet selected	Cost: unknown. GADNR, GA Power Company, and Georgia DNR currently maintaining forest canopy--no logging in habitat. No other, long-term goals for habitat management generated in recent years. Approx. 40 Eastern hemlocks treated at Panther Creek in 2010 with imidacloprid soil treatment to maintain hemlocks in forest canopy. May need retreatment circa 2015. Hand pulling of kudzu and English ivy in 2009-2010, at Panther Creek. Infestations of exotic species will require regular monitoring and control at Panther Creek and Tallulah Gorge--kudzu established at both locations and threatening to encroach on occupied habitat. First kudzu spraying at Panther Creek by GA Power initiated summer 2011, follow-up treatments necessary

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Persistent trillium (Trillium persistens)	3	3	Develop a commercial source of plants and provide for long-term storage	Obsolete		FY 2006	U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Work type not yet selected	Labor type not yet selected	Species is poor performer horticulturally. Difficult to remove tissue from cell culture and get self-sustaining plants. Little to no evidence of wild collection of these plants susequent to the species' listing--so collection pressure low and not seeming to increase since listing. Development of commercial stock may generate more interest in digging wild plants, since species would likely be expensive to buy commercially because of long periods necessary to get to flowering age and low reproductive rate. The endorsement of the USFWS for developing a "market" for endangered species may present philosophical dillemma.

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Persistent trillium (Trillium persistens)	1	4	Enforce laws protection the species and/or its habitat	Ongoing Current	Prior to FY 1995		U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Other: Law Enforcement, Other: Regulations	Internal Administrative, Internal Field Assistance	Initiation date based on species listing. No known prosecutions for removal from Federal property or illegal transport. Monitoring of populations from USFWS law enforcement probably not warranted, protection most likely from GA DNR park staff and from limitations on special use permits for entering Tallulah Gorge. No known disturbance from day-users at Panther Creek population. No known reports of digging/removal of plants subsequent to species listing.
Persistent trillium (Trillium persistens)	2	5.1	Prepare and distribute news releases	Ongoing Not Current			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, Public Affairs Office , South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Other: Information and Education	Internal Administrative, Internal Field Assistance, Internal Technical Assistance, Species Expert, Volunteer	Species not particularly charismatic, may be challenge to relate importance to public. A few publications were produced in 1980's, but with limited readership.

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Persistent trillium (Trillium persistens)	2	5.2	Prepare articles for popular and scientific publications	Ongoing Not Current			U.S. Fish and Wildlife Service, Endangered Species Division, U.S. Forest Service, Georgia Department of Natural Resources, Public Affairs Office , South Carolina Wildlife and Marine Resources Department , USFWS Regional Office 4, Georgia Power Company, Georgia and South Carolina Nature Conservancy	Other: Information and Education	Graduate Student, Internal Field Assistance, Internal Technical Assistance	Pence and Soukup published cell culture publication in 1995. Little to no funding allocated for research on this species in last 10-20 years.